## Space Weather Forecast

Issued on Thursday, 30 November 2023 at 01:26 Local

**This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: Moderate flares likely (R1-R2 Blackouts). G1-G2 Minor to Moderate storms likely, with a slight chance G3 Strong storms, due to multiple coronal mass ejection arrivals day 1-2 (30 Nov-01 Dec)**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Low, with only common class flares observed, the largest of which was at 29/0803 UTC, from the easternmost of a series of three weakening active region approaching the northwest limb. There are currently twelve sunspot regions on the disc, with the largest and most significant just west of the centre southern disc. This is comprised of a cluster of small dark-core spots, with a relatively simple magnetic structure. Some spreading of the spots was observed, but also some development of new spots within its northernmost extent. All other regions on the disc remain smaller and simpler, and either stable or showing signs of decay. There are also a number of filaments visible, which are lines of material held together by the Sun's Magnetic field. These can erupt to produce coronal mass ejections (CMEs)

No Earth-directed CMEs occurred during this period, however there are a number of other potentially Earthbound CMEs in the forecast from previous days.

**Solar Wind / Geomagnetic Activity:** Solar wind speeds were slightly elevated to near background, 380-450 km/s. Interplanetary Magnetic Field (IMF) was weak, with the north-south component also varying weakly but predominately negative (southward orientated). Geomagnetic activity was Quiet (Kp1-2).

**Energetic Particles / Solar Radiation:** The count rate of energetic particles (high energy protons) persisted at background with no solar radiation storms occurring.

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Low to Moderate with isolated Moderate flares (R1-R2 Blackout) likely, and a slight chance of an isolated Strong class flare (R3 Blackout). The moderately sized sunspot just west of the southern centre disc is most likely to be the source.

**Solar Winds / Geomagnetic Activity:** There are up to four Earth-directed CMEs. Three from 27 Nov, and the other, a more significant CME, originated from the Moderate flare on 28 Nov. Two CMEs are likely to arrive day 1 (30 Nov), with glancing impacts most likely, but could combine into a more notable enhancement. The M9.8 sourced CME is forecast to arrive during the morning of day 2 (01 Dec), although the speed of this CME is low confidence, allowing for a chance of an arrival as early as late on day 1 (30 Nov). This CME is also likely to sweep up and cannibalise the fourth CME, which was forecast to arrive later on day 2 (01 Dec), potentially enhancing the impact when this occurs. Aside from the CMEs, current Slightly Elevated to Background winds are forecast to continue easing. Geomagnetic activity is initially expected to be mainly Quiet. The CME arrivals are then likely to bring spells of G1/Minor or G2/Moderate geomagnetic storms on day 1 or more likely day 2 (30 Nov or 01 Dec) with a slight chance of G3/Strong storms. Geomagnetic activity then easing day 3 (02 Dec) although there remains a chance of isolated G1 Minor Storms, before returning to mainly Quiet by day 4 (03 Dec).

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This activity brings a chance of visible aurora to parts of the UK on days 1-2 (30 Nov-01 Dec), however the strongest activity is currently signalled to be during daylight hours, which would limit potential visibility to northern Scotland. There is a slight chance of views as far south as northern England, Wales and Northern Ireland given good views of the northern horizon.

**Energetic Particles / Solar Radiation:** The count rate of energetic particles (high energy protons) is expected to stay at background. However, any significant flares from the large spot will bring a chance of flux levels increasing, with a slight chance of approaching or perhaps exceeding the S1 Minor Radiation Storm level.

**Geomagnetic Storms:**

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 40 | 70 | 20 | 1 |
| Strong | G3 | No | 10 | 25 | 1 | 1 |
| Severe | G4 | No | 2 | 5 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

**Radio Blackouts - X Ray Flares:**

| X Ray Flares Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 M Class | No | 60 | 55 | 45 | 45 |
| Very Active | R3 to R5 X | No | 10 | 10 | 10 | 10 |

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**Solar Radiation Storms - (High Energy Protons):**

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 10 | 10 | 10 | 10 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

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